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Author: Dr. Luigi Ansalone
Agenzia Spaziale Italiana (ASI), Italy

Dr. Claudia Facchinetti
Italian Space Agency (ASI), Italy
Mr. Francesco Longo
Agenzia Spaziale Italiana (ASI), Italy
Mr. Roberto Formaro
ASI - Italian Space Agency, Italy
Dr. Giovanni Alberti

CO.RI.S.T.A., Consortium for Research on Advanced Remote Sensing Systems viale J.F. Kennedy 5,
80125 Naples, Italy, Italy

Dr. Giulia Pica
CO.RI.S.T.A., Consortium for Research on Advanced Remote Sensing Systems viale J.F. Kennedy 5,
80125 Naples, Italy, Italy

THE FUTURE PERSPECTIVES OF THE ITALIAN P-BAND AIRBORNE RADAR

Abstract

The use of penetrating radar from orbit it is nowadays a well proven technique: in 2005 MARSIS, the Italian experiment embarked on Mars Express, has shown the potential of a radar Sounder. The soil characteristics affect penetration capabilities, so a low amount of moisture allows an higher penetration capability, making desert areas more suitable. On Earth, Ground penetrating radars usually known as GPR, are used for specific applications such as locating buried pipes, old military devices and archeological surveys although the results are very limited for subsurface mapping of large areas, or non-accessible regions. The possibility of using airborne platforms operating in P-band appears to be promising in the Earth observation field. Helicopters, as example, may fly at different altitudes and allow multiple crossed passages over selected areas, increasing the capacity of identifying different features in the underground. Selection of the radar central frequency, bandwidth and pulse duration is the most critical aspect in the design of Sounding and SAR radars with respect to their scientific, civilian and military application goals. In this context, the Italian Space Agency recently promoted and supported the development of a new multi-mode and multi-band airborne radar penetrating system in P-band. The developed hardware is composed by a Sounder module at 163MHz and a Synthetic Aperture Radar module at 450MHz and 900MHz. The combined use of low frequency, high bandwidth and different polarization can guarantee several applications: biomass evaluation, archeological and geological exploration, deforestation and agriculture monitoring and detection of buried targets. The compact and lightweight system allows to operate in-flight a real-time switching between Sounder and SAR mode; several tests have been carried out installing the radar on helicopters and new processing algorithms will be developed to obtain higher-resolution images. The data analysis performed during the test campaigns showed the potentiality of the system and suggested some improvements on the system to enhance results, like the full polarization and the increasing of the Tx band. The upgrade of the system is on-going,. The SAR is considered as a proof-of-concept for future dedicated spaceborne missions but also for critical applications such as the mine clearance in old war zones. In this paper we report the results achieved so far, showing the best performance reached by

this system. A focus on the best areas of application in which this system can operate is shown and the new performance reached by the upgraded system is included.